

WHAT IS CLAIMED IS:

- 1     1.    A method of producing an article comprising a folded core  
2           structure, said method comprising the steps:
  - 3           a)    providing a material web having an initial flat planar  
4                configuration;
  - 5           b)    subjecting said material web having said initial flat  
6                planar configuration to a continuous pretreatment  
7                process comprising forming a repeating pattern of fold  
8                lines in said material web from an upper surface and  
9                a lower surface thereof;
  - 10          c)    after said step b), initiating a formation of folds in  
11                said material web along said fold lines on said upper  
12                surface and said lower surface;
  - 13          d)    after said step c), carrying out and completing said  
14                formation of said folds along said fold lines to  
15                deform said material web from said initial flat planar  
16                configuration into a three-dimensionally folded  
17                configuration having an increased thickness relative  
18                to said flat planar configuration, whereby said  
19                initial flat planar configuration of said material web  
20                undergoes a longitudinal contraction in a longitudinal  
21                direction of said material web, a transverse  
22                contraction in a transverse direction of said material  
23                web, and a thickness expansion in a direction of said  
24                thickness; and

e) after said step d), post-treating said material web to stabilize said folded configuration thereof, to produce therefrom a folded core structure.

2. The method according to claim 1, further comprising, after said step e), a further step of arranging and attaching a respective cover layer on at least one major surface of said folded core structure to produce therefrom a composite structural panel.

3. The method according to claim 1, wherein said step a) comprises providing a web comprising composite reinforcement fibers as said material web.

4. The method according to claim 1, wherein said longitudinal contraction, said transverse contraction and said thickness expansion all occur simultaneously in a single-stage folding process in said step d), and wherein said single-stage folding process is carried out without mechanical guidance of said material web parallel to said fold lines.

5. The method according to claim 1, wherein said transverse contraction and said thickness expansion occur together in a first stage of a folding process in said step d) without said longitudinal contraction, and thereafter said longitudinal contraction occurs in a second stage of said folding process, and further comprising compensating for a

7 travel distance variation of edge portions of said material  
8 web relative to a center portion of said material web  
9 during said first stage of said folding process.

1 6. The method according to claim 1, wherein said pretreatment  
2 process comprises at least one of embossing, impressing,  
3 creasing, scoring, and perforating said fold lines into  
4 said material web.

1 7. The method according to claim 1, wherein said pretreatment  
2 process further comprises at least one of heating said  
3 material web, cooling said material web, etching said  
4 material web, applying a binder to said material web, and  
5 impregnating a resin into said material web.

1 8. The method according to claim 1, wherein said post-treating  
2 in said step e) comprises at least one of embossing,  
3 pressing, creasing, scoring, and perforating said material  
4 web.

1 9. The method according to claim 1, wherein said post-treating  
2 in said step e) comprises at least one of heating said  
3 material web, cooling said material web, etching said  
4 material web, applying a binder to said material web, and  
5 impregnating a resin into said material web.

1 10. The method according to claim 1, wherein said initiating of  
2 said formation of said folds in said step c) comprises

directing a flow of a fluid at at least one of said upper surface and said lower surface of said material web.

11. The method according to claim 1, wherein said initiating of said formation of said folds in said step c) comprises mechanically contacting at least one of said upper surface and said lower surface of said material web so as to begin said formation of said folds.

12. The method according to claim 1, wherein said completing of said formation of said folds in said step d) comprises passing said material web between two bristle brush rolls that respectively contact said upper surface and said lower surface of said material web, whereby respective bristles of said two bristle brush rolls intermesh with each other as said material web is deformed and folded along said fold lines between said respective bristles of said two bristle brush rolls.

13. A method of producing a folded structure, comprising the steps:

- a) providing a material web having an initial flat planar configuration;
- b) forming a repeating pattern of fold lines in said material web by at least one of embossing, impressing, creasing, scoring, and perforating said fold lines into said material web still having said flat planar configuration;

- 10 c) initiating a formation of folds in said material web  
11 along at least some of said fold lines by directing  
12 jets of a fluid at said material web;
- 13 d) passing said material web between two intermeshing  
14 bristle brush rolls so as to further form said folds  
15 in said material web, whereby said initial flat planar  
16 configuration of said material web undergoes a  
17 longitudinal contraction in a longitudinal direction  
18 of said material web, a transverse contraction in a  
19 transverse direction of said material web, and a  
20 thickness expansion in a direction perpendicular to  
21 said longitudinal direction and said transverse  
22 direction, from said initiating of said formation of  
23 said folds through said further forming of said folds,  
24 so as to deform said material web from said initial  
25 flat planar configuration to a resulting  
26 three-dimensionally folded configuration; and
- 27 e) stabilizing said three-dimensionally folded  
28 configuration by at least one of accentuating,  
29 pressing, strengthening, rigidifying, and fixing said  
30 folds, so as to form a folded structure of said  
31 material web having said three-dimensionally folded  
32 configuration.

1 14. An apparatus for producing a structure comprising a folded  
2 core structure fabricated from a planar material web, said  
3 apparatus comprising:

4           a first arrangement for pre-treating the material web  
5           from an upper surface and a lower surface thereof to form  
6           fold lines therein;

7           a second arrangement for initiating a folding process  
8           of forming folds along at least some of the fold lines in  
9           the material web;

10          a third arrangement for proceeding with the folding  
11          process and longitudinally retarding the material web,  
12          including at least one pair of counter-rotating bristle  
13          brush rolls or bristle brush conveyor belts to form a  
14          folded structure; and

15          a fourth arrangement for post-treating the material  
16          web on the upper surface and the lower surface thereof to  
17          stabilize the folded structure.

1   **15.** The apparatus according to claim 14, wherein said first  
2       arrangement comprises a pair of counter-rotating rolls  
3       including at least one roll having a structured surface; a  
4       pair of link chains or belts including at least one link  
5       chain or belt having a structured surface, or a conveyor  
6       belt having a structured surface.

1   **16.** The apparatus according to claim 15, further comprising an  
2       apparatus for varying a running length between said first  
3       arrangement for pre-treating the material web and said  
4       second arrangement for initiating the folding process.

1 17. The apparatus according to claim 14, wherein said third  
2 arrangement further comprises an arrangement for  
3 contracting a transverse width and expanding a thickness of  
4 the material web, including a pair of counter-rotating  
5 rolls having a structured surface and an adjustable axis  
6 spacing, or a comb-like arrangement with an adjustable gap,  
7 as well as an arrangement for compensating a running length  
8 of the material web.

1 18. The apparatus according to claim 17, further comprising a  
2 mechanical arrangement or a pneumatic arrangement operating  
3 with a fluid pressure for deforming the material web in a  
4 direction of the transverse width.

1 19. The apparatus according to claim 14, wherein said second  
2 arrangement comprises a row of movably arranged fluid  
3 nozzles.

1 20. The apparatus according to claim 14, wherein said third  
2 arrangement comprises a row of movably arranged fluid  
3 nozzles.

1 21. The apparatus according to claim 14, wherein said fourth  
2 arrangement comprises a pair of counter-rotating rolls,  
3 conveyor belts, or link chains or belts, having a  
4 structured surface including a pattern of edges, and  
5 wherein the folded structure has a pattern corresponding to

6 a circumferential development of the pattern of edges of  
7 the structured surface of the fourth arrangement.

1 **22.** The apparatus according to claim 21, further comprising an  
2 arrangement for heating, cooling, coating or impregnating  
3 the material web.

1 **23.** The apparatus according to claim 14, further comprising an  
2 arrangement for applying at least one additional material  
3 web onto the folded structure.

1 **24.** The apparatus according to claim 14, further comprising an  
2 arrangement for cutting and transporting-away the material  
3 web.